

California Public Works Studies Program

**EVALUATION OF MARKED AND UNMARKED  
CROSSWALKS  
AT INTERSECTIONS IN CALIFORNIA**

*Final Report*

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| 16. Abstract<br><p>For two decades transportation agencies in California have been reluctant to mark pedestrian crosswalks. Studies in California concluded that at unsignalized intersections, marked crosswalks have a higher frequency of accidents than unmarked crosswalks. Recent work supported by the FHWA called in question the California practice. The objective of this study was to examine numerous marked and unmarked crosswalks to compare the accident experiences. After a literature search, 380 intersections out of more than 10,000 on California state highways were selected at random. Five years of accident data and 1989 traffic volumes were obtained for all 380 intersections. Pedestrian counts were completed at 55 of the intersections.</p> <p>The analysis utilized the Wilcoxon Rank Sum tests to assess whether or not there were differences in pedestrian-vehicle accident rates between intersections with and without markings. The major results were: 1) at unsignalized intersections marked crosswalks clearly featured higher pedestrian-vehicle accident rates than unmarked crosswalks; 2) for signalized intersections the results were inconclusive; 3) there is no compelling reason for Caltrans to change intersection crosswalk marking policy.</p> |  |  |  |  |  |
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## 6.0 FINDING AND CONCLUSIONS

The topic of the safety effects of crosswalk markings on pedestrian-related accident rates was examined thoroughly in this project. Previous research offered conflicting evidence as to the effects of crosswalk markings on accident rates. This study measured accident rates on state highway approaches and at intersections using pedestrian field counts and pedestrian volume estimates.

### 6.1 FINDINGS

The Literature Review offered the following significant findings:

1. California law requires that motorists must yield right-of-way to pedestrians who are crossing the roadway at any marked or unmarked crosswalk. At the same time, the provisions of the statute do not relieve the pedestrian from exercising due care for his own safety. Pedestrians are prohibited from sudden departures from the curb that would place them in jeopardy from an approaching vehicle.
2. With a few exceptions, notably California and possibly Ohio, enforcement of pedestrian laws receives little emphasis. Officials seem to be saying that enforcement would be extremely unpopular and not worth the effort.
3. Behavior modification through education has been shown to be an effective method to improve pedestrian street crossing behavior, and thus safety, particularly among elementary school aged children.
4. There is a concern that marked crosswalks may be more of a detriment than a benefit with respect to pedestrian safety.
5. A key factor in safety at marked crosswalks vs. unmarked crosswalks is the degradation in looking behavior and a more aggressive (arrogant) attitude of pedestrians using marked crosswalks.

6. Well-marked crosswalks experience fewer pedestrian violations than poorly marked (worn) crosswalks.

7. Motorists did not exhibit significantly altered behavior in terms of vehicular operating speeds when confronted with marked vs. unmarked crosswalk configurations. Pedestrians were more likely to remain within the parallel stripes when using newly marked or re-marked crosswalks.

8. Marking crosswalks may result in an increase in rearend accidents.

9. The excellent study by Tobey et al. (1983) suggested:

- Intersections without signals were more hazardous to pedestrians than those with signals.
- Intersections without any control were even more hazardous to pedestrians than those without signals.
- Intersections without marked crosswalks were more hazardous to pedestrians than those without any control.
- However, intersections with stop signs were much less hazardous to pedestrians than those without any control.

10. According to one study, improvements in crossing locations along with marked crosswalks seem to have lower accident rates in England, though this may not apply to the United States. Introduction of crosswalks seemed to have a greater positive impact on accident levels at night and in wet weather.

11. Several agencies use general warrants to determine whether or not marked crosswalks are needed. Most are based on either a point system or use of a graph. There are no uniformly accepted warrants. Specific guidelines seem to help reduce the number of marked crosswalks placed because of public pressure (clamor).

12. A serious failing in making crosswalk safety comparisons is the lack of a good exposure-based pedestrian accident rate and the data to calculate such a rate. Pedestrian volume data are generally not available and agencies lack the resources to gather such data routinely.

The Analysis of Data provided several significant findings:

1. Considering the crosswalks on the state highway approaches for all intersections in the database, both those with pedestrian counts and estimated pedestrian volumes had higher pedestrian-related accident rates at marked crosswalks. They were higher by a factor of 3.2 to 3.7 times.
2. For all intersections with either marked or unmarked crosswalks all around the intersection, only the data file with estimated pedestrian volumes was significant. The marked crosswalk pedestrian-related accident rate was 7.0 times higher.
3. When analyzing only intersections with accidents, none of the tests were significant. This data set of course contains the more hazardous crosswalks. Consequently, tests comparing portions within this data set, i.e., signalized and unsignalized, were less likely to find differences in pedestrian-related accident rates.
4. In the case of unsignalized intersections three of eight tests were significant. In each of these three cases the marked crosswalk pedestrian-related accident rates were six to seventy-five times higher than were those of the unmarked crosswalks.
5. Two of the eight tests for signalized intersections were significant. They were the files for crosswalks on state highway approaches for all intersections. In the case of the data file with pedestrian counts, the pedestrian-related accident rate for marked crosswalks was much higher than that for the unmarked. For the estimated pedestrian counts, however, the unmarked crosswalk pedestrian-related accident rate was higher, but only by 1.4 times.

## 6.2 CONCLUSIONS

Twenty-one distinct analyses were successfully performed to determine whether there was a significant difference in pedestrian accident rates between marked and unmarked crosswalks on state highways in California. Eight of those tests yielded significant results. In every case but one, the mean pedestrian accident rate of the marked crosswalk was greater than for the unmarked crosswalk. For unsignalized intersections, marked crosswalks clearly had a higher pedestrian accident rate.

This was consistent with earlier studies in California. The results of the analysis of signalized intersections were inconclusive. Based on the results of this project it would appear that Caltrans has no compelling reason to change its policy on marking crosswalks.

There is an apparent conflict between the results of this project and the work of Tobey et al. (1983). The Tobey work indicates that intersections with unmarked crosswalks are more hazardous than marked crosswalks. These intersections with unmarked crosswalks also include the intersections without control. Most likely more intersections without control were also without marked crosswalks than those with control. In contrast to the Tobey effort, this research project used only intersections with stop signs or signals. Consequently, different results would not be surprising. Additionally, the Tobey work did not specifically analyze marked vs. unmarked crosswalks in combinations with signalized vs. unsignalized intersections.

Some questions not directly related to the issue of marked and unmarked crosswalks could be addressed with the data base. Valuable insights may be attained by pursuing these issues.

1. Analyzing pedestrian-related accident characteristics (i.e. impairment).
2. Whether or not intersection improvements altered the pedestrian-related accident rates.
3. Reporting of pedestrian-related accident data (i.e. movements prior to collision).
4. Developing correlations (i.e. population vs. pedestrian-related accident rate).